MONTHLY WEATHER REVIEW.

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INTRODUCTION.

The MONTHLY WEATHER REVIEW for May, 1902, is based on reports from about 3,100 stations furnished by employees and voluntary observers, classified as follows: Regular stations of the Weather Bureau, 162; West Indian service stations, 13; special river stations, 132; special rainfall stations, 48; voluntary observers of the Weather Bureau, 2,562; Army post hospital reports, 18; United States Life-Saving Service, 9; Southern Pacific Railway Company, 96; Hawaiian Government Survey, 200; Canadian Meteorological Service, 33; Jamaica Weather Office, 160; Mexican Telegraph Service, 20; Mexican voluntary stations, 7; Mexican Telegraph Company, 3; Costa Rican Service, 7. International simultaneous observations are received from a few stations and used, together with trustworthy newspaper extracts and special reports.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Meteorologist to the Hawaiian Government Survey, Honolulu; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; Lieut. Commander W. H. H. Southerland, Hydrographer, United States Navy; H. Pittier, Director of the Physico-Geographic Institute, San Jose, Costa Rica; Capt. François S. Chaves, Director of the Meteorological Observatory, Ponta Delgada, St. Michaels' Azores; W. M. Shaw, Esq. Secretary, Meteorological Office' London; and Rev. Josef Algué, S. J., Director, Philippine Weather Service.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to conform generally to the modern international system of standard meridians, one hour apart, beginning with Greenwich. The Hawaiian standard meridian is 157° 30′, or $10^h\ 30^m$ west of Greenwich. The Costa Rican standard of time is that of San Jose, $0^h\ 36^m\ 13^s$ slower than seventy-fifth meridian time, corresponding to $5^h\ 36^m$ west of Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local standard is mentioned.

Barometric pressures, whether "station pressures" or "sea-level pressures," are now reduced to standard gravity, so that they express pressure in a standard system of absolute measures.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

The storms of the north Atlantic were of moderate intensity. During the 15th and 16th a disturbance passed from west of Scotland over the North Sea. It increased in strength during the 17th and 18th, and on the morning of the 18th the reading of the barometer at Cuxhaven, Germany, was 29.28 inches. By the 19th the storm center had disappeared over the continent. The most important storm of the month over the British Isles covered the north of Scotland on the 28th, when the barometer read 28.96 inches at Stornoway, and 28.98 inches at Sumburg. During the 29th this disturbance disappeared east of Scotland. On the 31st the barometer read 29.58 inches at Lisbon, Spain, and a disturbance was apparently central over or slightly west of the Bay of Biscay.

No important storm occurred on the Atlantic seaboard or the Great Lakes of the United States after the first decade of the month. During the 6th and 7th a storm center passed north of east over the upper lakes and eastern Ontario attended by high winds that reached a reported maximum velocity of 48 miles an hour at Buffalo, N. Y. This storm was followed by a disturbance that passed rapidly from the British Northwest Territory to Lake Superior during the 7th and and 8th, and thence to the lower St. Lawrence Valley by the morning of the 9th, attended by winds that reached a velocity of 52 miles an hour at Chicago, Ill., 48 miles at Cleveland, Ohio, and Buffalo, N. Y., 60 miles at New York, N. Y., and 40 miles at Portland, Me. Storm warnings were displayed on the Great Lakes during the 8th, 9th, and 10th; advisory messages were telegraphed Atlantic ports from Hatteras, N. C., to Eastport, Me., on the 8th, and storm warnings were displayed on the New England coast during the 9th.

There was an unusual amount of frost in the northern tier of States, and in the Rocky Mountain and Plateau districts, and on the 27th snow was reported in the mountains of Maryland and western Pennsylvania, and in western and northern New York. Timely warnings were issued in the agricultural district in which frost occurred.

During the 17th, 18th, and 19th thunderstorms occurred from the States of the lower Missouri Valley to Texas, the severest storm of this period being reported at Goliad, Tex., where 200 people were killed and considerable property was destroyed.

The Weather Bureau forecasts conditions that favor the occurrence of thunderstorms; it is not possible, however, to define the localities in which storms of this general type will assume the form and acquire the intensity of tornadoes.

BOSTON FORECAST DISTRICT.

The gales of the early part of the month, and the frost that

occurred at intervals in the interior of New England, were successfully forecast.—*J. W. Smith, Forecast Official.*

NEW ORLEANS FORECAST DISTRICT.

The following special warning was issued at 12:15 p. m. of the 18th: "Squalls, with brisk and occasionally high winds are indicated for the west Gulf this afternoon and to-night." Unusually severe squalls occurred Sunday afternoon and night over southern Texas and along the coast. At Goliad, Tex., a tornado killed 200 people and destroyed much property.—*I. M. Cline, Forecast Official.*

CHICAGO FORECAST DISTRICT.

No severe storms occurred on the upper lakes, and no mishaps of moment were reported. Frosts occurred in the western Lake region and in the Northwest several times during the month. Previous to their occurrence warnings were generally issued, and it is not thought that any serious damage resulted. There were a number of thunderstorms during the month, which caused an unusually large amount of rainfall in nearly all sections, making up to a large extent for the drought which prevailed during the fall and winter. These thunderstorms were almost invariably correctly forecast.—*H. J. Cox, Professor.*

DENVER FORECAST DISTRICT.

Special warnings were given distribution on the 18th for the heavy frost that visited Utah and western Colorado. Frosts that occurred in the agricultural districts on other dates, except in northern New Mexico, were generally covered in the daily forecasts.—*F. H. Brandenburg, Forecast Official.*

SAN FRANCISCO FORECAST DISTRICT.

An area of high pressure off the central coast on May 17 and, at the same time, an extensive trough of low pressure over the Rocky Mountain region, were accompanied by high winds generally in California and Nevada. Especially in the vicinity of Point Reyes did the winds reach a high velocity; a maximum of 108 miles and an extreme velocity of 120 miles being reported at that station on the 18th.—*A. G. McAdie, Professor.*

PORTLAND, OREG., FORECAST DISTRICT.

No severe storms occurred during the month. Frosts which, as a rule, were accurately forecast occurred frequently in the eastern sections from the 2d to the 5th, and occasionally until the close of the month.—*E. A. Beals, Forecast Official.*

RIVERS AND FLOODS.

The mean stages in the upper Mississippi River averaged from 2.5 to 5.5 feet higher than during the preceding month. They were also somewhat higher than during the corresponding period of the preceding year. The lower Mississippi, the Ohio, and the Tennessee, fell steadily, but remained at an excellent navigable stage at the close of the month.

The rivers of the East and South were lower, except the Brazos, where there was a considerable rise, due to heavy local rains. During the last days of the month there was also a sharp rise in the Arkansas River on account of continued heavy rains over its upper watershed, and some reports of flooding and damage were received from the Kansas portion.

West of the Rocky Mountains the feature of interest was the annual rise of the Columbia River which began on the 15th of the month. Its coming was well heralded, and ample time was afforded for all necessary preparations.

The highest and lowest water, mean stage, and monthly range at 138 river stations are given in Table VII. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are: Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, Forecast Official.*

AREAS OF HIGH AND LOW PRESSURE.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocity.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
High areas.										
I	*29, p.m.	50	100	4, p. m.	46	60	2,250	5.0	450	18.8
II	2, p.m.	41	124	7, a. m.	45	64	3,550	4.5	789	32.9
				8, a. m.	38	86	3,350	5.5	609	25.4
III	7, p.m.	54	114	12, p. m.	46	60	2,900	5.0	580	24.2
IV	12, p.m.	53	108	17, a. m.	32	65	2,875	4.5	639	26.6
V	20, a.m.	48	86	23, a. m.	32	65	1,900	3.0	633	26.4
VI	24, p.m.	54	114	30, a. m.	36	76	2,450	5.5	445	18.6
VII	30, a.m.	48	86	31, p. m.	41	70	900	1.5	600	25.0
Sums							20,175	34.5	4,745	197.9
Mean of 8 paths							2,522		593	24.7
Mean of 34.5 days									585	24.4
Low areas.										
I	*30, a.m.	41	112	4, a. m.	32	65	3,350	4.0	838	34.9
II	2, p.m.	38	105	6, a. m.	46	60	2,700	3.5	771	32.1
III	5, p.m.	41	97	7, p. m.	48	68	1,600	2.0	800	33.3
IV	6, p.m.	32	94	8. a. m.	35	76	1,050	1.5	700	29.2
V	6, p.m.	54	114	10, a. m.	46	60	2,550	3.5	728	30.3
VI	17, a.m.	46	106	20, p. m.	51	104	2,000	3.5	571	23.8
VII	25, a.m.	42	83	28, a. m.	48	68	975	3.0	325	13.5
Sums							14,225	21.0	4,733	197.1
Mean of 7 paths							2,032		676	28.2
Mean of 21.0 days									678	28.2

*April.

For graphic presentation of the movements of these highs and lows see Charts I and II.—*Geo. E. Hunt, Chief Clerk, Forecast Division.*

CLIMATE AND CROP SERVICE.

By JAMES BERRY, Chief of Climate and Crop Service Divison.

The following summaries relating to the general weather and crop conditions are furnished by the directors of the respective sections of the Climate and Crop Service of the Weather Bureau:

Alabama.—Conditions favorable for cultivation, but generally too dry for late planted staple crops, particularly so in some northern counties, where a drought, which began about April 17, continued practically unbroken.—*Frank P. Chaffee.*

Arizona.—Unseasonably cold weather, extreme aridity of the atmosphere, high, drying winds, and an insufficient supply of water in the irrigated districts, combined to produce very unfavorable conditions for plant development during the month. The quality of the hay crop was below the average. The ranges had a scanty supply of feed and water, and were deteriorating at close of month.—*Wm. G. Burns.*

Arkansas.—The weather conditions during the month were generally favorable for farming operations, and work progressed rapidly. Corn planting was completed in some localities during the first week, and was completed in all sections by the close of the month. The early planted had generally come up to good stands and cultivation was well under way; some had been laid by during the last week. Cotton had begun to come up by the second week and was being chopped out in many sections;